first line of the triplet should be. But this one is out of the question on account of its enormous energy, which would be quite out of comparison with the other lines. So we must suppose that the first line of the triplet is concealed by the strong line. Indeed, on the plates Prof. Kayser and I have examined, it would be impossible to detect a line close to 2852. Again, as in the spectrum of thallium, these triplets form two series (see Fig. 3), and again we find that the wave-numbers of the first, second, and third lines in each series are very accurately represented by a formula,

$$A - Bn^{-} - Cn^{-4},$$

n standing for the row of entire numbers. For each series there are three values of A, but only one value of B, and one value of C. The three values of A are very nearly the same in both series, indicating that the ends of both series coincide. The lowest number for which the formula gives a positive value is $n = 3$. To this value corresponds the strong green triplet. But in the other series the corresponding triplet ought to be found near 13000 10^{-8} cm. where photographic methods fail. It may be that it is identical with the lines that Becquerel has found near 12000 and 12120, the first of which, he says, is possibly double. The deviation between these and the calculated values is not so very great, considering the wide extrapolation of the formula. A small change in the value of C would alter the formula much more for $n = 3$ than for the higher values of n. Besides, we believe the formula only to be an approximation to the true function which may be developed into a series of descending powers of n^2. If this is so, the neglected terms would affect the values of the formula much more for the low values of n, than for the higher ones. The separation of the triplets into two series is not only suggested by the symmetry of the distribution, but also by the aspect of the lines.

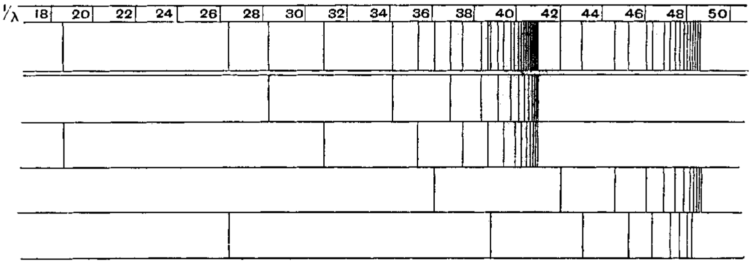

FIG. 2.

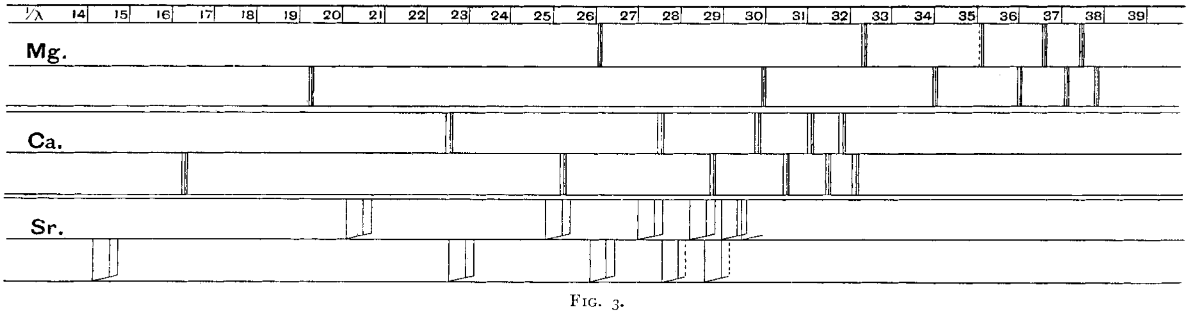

FIG. 3.

In the spectra of calcium and strontium, we also find triplets with the same differences of wave-numbers, and their appearance teaches us in each spectrum to separate them into two series. We then see that the distribution of triplets shows a remarkable similarity to that in the spectrum of magnesium.

The dotted lines in the figure mean that the corresponding rays have not been identified with certainty. There are many lines beside those forming the triplets. For magnesium, the triplets contain 33 out of 56 lines, for calcium 33 out of 106, for strontium 29 out of 97. We have found that, as a rule, the higher the melting point of an element, the greater is the percentage of lines in the arc spectrum that do not belong to the series. From magnesium to calcium, and from calcium to strontium, the triplets widen and shift to the less refrangible side of the spectrum. The same thing happens in the spectra of other groups of chemically-related elements, the difference of wave-numbers of the doublets or triplets being somewhat proportional to the square of the atomic weight.

There is one more feature which seems interesting in regard to the connection of the spectra of different elements. In all the formulæ of series that have been observed, the coefficient of n^{-2} does not vary more than about 10 per cent. from its mean value, if we except one of the two series of doublets in the spectrum of aluminium where the variation is somewhat larger. I think, when in some time a satisfactory theoretical explanation of the symmetry in the spectra of the elements will be given, this co-efficient will prove to be an important physical constant.

C. RUNGE.

KARL VOGT.

THE life of Prof. Karl Vogt, who died on May 6, was no tranquil scientific career, for he was a fighting philosopher. He first comes into notice in 1839, working with Agassiz, then Professor at Neuchatel, on the "Freshwater Fishes of Central Europe." This great work, never completed, determined the direction of Vogt's best research during the rest of his long life. It was only in 1888–94 that the "Traité d'Anatomie Comparée," by Vogt and Jung, was published in Paris, taking high rank as a standard authority, and likely to retain it. He returned from Paris to his native town of Giessen, where he had been appointed Professor. But the revolution of 1848 soon burst forth, and we hear of him as an advanced Democratic Deputy contending for liberty and progress with the trenchant oratory he could use alike in politics and science Political forces were too strong against him, and he had to depart from his university and country, finding a home again in Switzerland, where he took up the double life of biologist and politician as a Professor at Geneva, and a prominent member of the National and Federal Council. His all-round knowledge is testified to by papers on Alpine geology, petrology, and prehistoric archæology. Those who were present at the Norwich meeting of the Congress of Prehistoric Archæology in 1868, remember his robust presence and slashing speech. To this subject, at the time rising into notice, belong Vogt's discourses, well known in the English translation, edited by Dr. James Hunt, and published by the Anthropological Society in 1864 under the title "Lectures on Man: his Place in Creation, and in the History of the Earth." There is so much forcible reasoning in this book, that it may still be read with profit thirty years after date. It is true that the thesis of the book which gained it favour with the polygenist school, whose desire was to trace the races of mankind to several locally and specifically distinct origins, is one which would nowadays hardly find supporters among anthropologists. Vogt held that the various branches of the human race trace their pedigrees to corresponding branches of the anthropomorpha. He cannot see "why American races of man may not be derived from American apes, Negroes from African apes, and Negritos, perhaps, from Asiatic apes." In these lectures Vogt shows a by no means admirable mode of controversy by unpleasant epithets, more or less like those which, in Germany as elsewhere, the orthodox world had poured on "infidels" and "materialists." But his sense of humour was blunt, and he evidently did not see that religion, which has swayed the universal human mind from untold ages, is a cosmic force which, by its very immensity, should be out of the reach of jokes like calling a low-type cranium an "apostle-skull." Even more remarkable in this respect is Vogt's "Köhlerglaube und Wissenschaft," an invective in the name of science on the credulous piety which, in countries where the trade of the charcoal-burner is plied, finds its best example among these isolated ignorant forest-folk. To the newer school of anthropologists, the term "charcoal-burner's belief" suggests quite a different sense. One would sit down by them and question them in order to find surviving in their minds ideas which are fossils from the most ancient times.

As a zoologist Vogt's reputation rests upon less equivocal grounds. The subject supplied him with fewer opportunities of displaying his anti-theological bias, and he brought his great powers to bear upon a number of problems, with the result that he added largely to the progress of zoology. His writings are numerous, and range over a wide variety of subjects; and he by no means confined himself to comparative anatomy, but made observations which entitled him to honourable rank among physiologists. In his "Traité d'Anatomie Comparée" he tells us, in the preface to the second volume, that he has studied and dealt monographically with no less than twenty-two types of animals, belonging to nearly every class of the animal kingdom. Much of this work was begun in the earlier part of his career, when he published many papers and several monographs upon the forms which he has afterwards chosen as types in his text-book. He was an active embryologist in earlier days, and wrote on the development of Filaria (1842), Batrachia (1844), Cephalophora (1856), and Crustacea (1873). In 1853 he published observations on the fertilisation of the ovum. He made a special study of the Siphonophora in 1852–54, and produced in 1868 an admirably illustrated monograph, entitled "Recherches sur les Animaux inférieurs de la Méditerranée," which deals with Siphonophora and pelagic Tunicata. His work on Branchipus and Artemia, published in 1872, is well known. Vogt's activity did not decrease with advancing years, as is testified by his contributions to current scientific literature and the publication of his text-book. His abilities were great, and he had a keen appreciation of the importance of the special problems of zoology to which he directed his attention. But his interests were too various, and his work ranged over too great a number of subjects, to admit of his rising to the position of a first-rate authority in any one of them. Had he applied himself solely to one course of study he would, by his powers of investigation and his vigorous method of exposition, have found a place among the foremost biologists of the century. As it was, he dissipated too much energy and thought in attempting to grasp too wide a range of knowledge.

E. B. T.
G. C. B.

At the meeting of the Paris Academy on May 6, M. Blanchard referred in the following terms to the part Vogt took in the study of the formation and movement of glaciers, under the direction of Louis Agassiz.

"At the beginning of August 1845, Agassiz arrived at the hospital of Grimsel, accompanied by Carl Vogt, Desor, Nicolet, and two students from Neuchatel. They brought their instruments with them, for they had come with the idea of determining the temperature of the glaciers, of studying the form of the snow, and of ascertaining in what manner the *névé* forms itself into ice.

"They had with them two very experienced men as guides; they resolved to take up their position on the smaller glacier of the Aar, which is of special interest; the surface is strewn with masses of rock, which produces an effect of a heap of ruins. On approaching the moraine, the investigators perceived that the glacier had advanced considerably since the previous year. A hut, left by Hügi, one of the first explorers, had disappeared.

"After a brief survey, they fixed the place of installation near a large block, and the guides set to work to build a small house large enough to hold six people. The walls were built of dry stones; large flagstones served as boards; beds were made of layers of grass, covered with oilcloth and other coverings, and were thought perfect.

"As a matter of fact, the opening which gave access to the house was very small, but still Carl Vogt could enter, and where Carl Vogt could pass every one could. Instead of a door, a curtain was put up. In the night, before going to bed, it was decided that the dwelling should be called the "Hôtel des Neufchâtelois"; this name was, therefore, cut on the rock in big letters, and time has consecrated it.

"Does not this reunion of young savants in the solitude, in the middle of a nature both grand and sad, offer a curious spectacle to the imagination? The noises of the pleasures of this world and of public affairs does not ascend as far as the hut on the glacier of the Aar: aspirations and joys, unknown to most mortals, agitate the hearts there. These men, who without effort, without regret, renounce comfort for many a long day, dream of penetrating into the deepest secrets of nature; they discuss gravely most formidable questions, and laugh over many incidents. Agassiz never loses his good humour, and Desor abandons himself to joking. Carl Vogt, always sparkling with fun, and himself capable of enlivening an assembly of monks, effectually prevents the possibility of *ennui*.

"Amongst the investigators, who are stirred by the same thought, peace is never broken; on the sea of ice, with no other witnesses than the blocks of granite, and the peaks covered with eternal ice, there are no rivals. In proportion to the extent of his aptness every one sets himself with energy to the common work. Agassiz is the undisputed chief, the recognised master. To bring a stone to the monument he was building, was the only thing the zealous workers cared about.

"They rose early at the 'Hôtel des Neufchâtelois'; on the stroke of four they had to be up. The time of dressing was rather trying, as the water was so cold and made them shiver; but that over, nothing more was thought of than continuing their research. Agassiz volunteers to bore holes; the ice can only be cut with great difficulty, for it resists the instruments. While this operation is being done, Carl Vogt examines the red snow, the strange hue of which is due to the presence of myriads of microscopic beings; he discovers many kinds of infusoria, and a pretty rotifer sowing the snow with its purple-coloured eggs.

"Carl Vogt was never inactive; in the last years he published, together with M. Jung, a treatise on zoology. Every one will acknowledge that a life so well spent is an honour to humanity." W.

NOTES.

Science is but poorly represented in the list of the Queen's birthday honours. Lord Playfair, previously a K.C.B., has accepted the honour of G.C.B. Rear-Admiral W. J. L. Wharton, Hydrographer to the Navy, has been made a Companion of the Order of the Bath. Mr. W. M. Conway, whose climbs in the Himalayas led to the publication of some interesting scientific results, has been knighted.

Dr. E. Frankland, F.R.S., Correspondent of the Paris Academy of Sciences, has been elected Foreign Associate, in the place of the late Prof. van Beneden.

Dr. Esmarch, of Kiel, has been elected a Correspondent of the Paris Academy of Medicine.

Prof. Thommsen, who has been a Corresponding Member of the French Academy of Inscriptions since 1860, has been elected a Foreign Associate, in the place of the late Sir H. Rawlinson.

The *Times* correspondent at Melbourne says that a meteorological observatory has been established on the summit of Mount Wellington, Tasmania.

A million acres of forest land has been reserved by the Province of Ontario as a great natural park for the preservation of native animals and plants.

The discourse at the Royal Institution to-morrow evening will be delivered by the Earl of Rosse, the subject being, "The Radiant Heat from the Moon during the progress of an Eclipse." That on June 7 will be by Prof. A. Cornu, F.R.S. This lecture will be delivered in French, and the title will be, "Phénomènes Physiques des Hautes Régions de l'Atmosphère."

Through a gift of Mr. W. C. McDonald (says *Science*), McGill University has secured thirty-five acres of land for botanical gardens and an observatory. From the same source we learn that the residue of the estate of Mary D. Peabody has been left to the Catholic University of Washington, for the foundation of scholarships (probably three or four of the value of 5000 dollars each) in the chemical and physical sciences.

Among the appointments abroad, we notice that Dr. N. V. Ussing has accepted the Professorship of Mineralogy in the University of Copenhagen, Dr. F. Karsch has become Extraordinary Professor of Zoology in Berlin University, Prof. Emil Behring has become Ordinary Professor of Hygiene at Marburg, and Dr. Zorawski (privat-docent in mathematics at Krakau) has been promoted to an Extraordinary Professorship.

The electrical power developed at the Niagara Falls will soon take the place of steam for several hundred miles distance from the Falls, including New York City. An important proposed application is to the Erie Canal, which has just opened for the season. Experiments will be made for applying the power by a trolley system, and the reduction of expense will probably drive out all other means of transportation for grain, &c., from Buffalo to tide water, during the season of navigation.

At the International Horticultural Congress, opened at Paris on Saturday, resolutions were unanimously adopted to the effect: "(1) That the French Government should associate itself with the request addressed by the Italian Government to the Swiss Confederation, with a view of obtaining the revision of the Berne International Convention, and the free circulation between all countries signatory to the convention, of all vegetables and vines, accompanied by a certificate of origin; and (2) that the postal administration should return to the old reduced tariff, of which periodical publications on horticulture have hitherto had the advantage."

Efforts are being made (says the *American Naturalist*) to raise a fund of 12,000 dollars for the purpose of bringing Mr. Peary and his two assistants home from North-west Greenland early next autumn, and, in connection with this, to prosecute scientific investigations during the available summer season. It is hoped, by this means, to charter and fit out a staunch steamer, built for Arctic service and commanded by experienced Arctic navigators, which shall start from St. John's, Newfoundland, on or about July 5, 1895, for Inglefield Gulf, North-west Greenland, lat. 78° N., Mr. Peary's headquarters.

We have received a notice concerning three "Priestley" Scholarships in Chemistry, two "Bowen" Scholarships in Engineering, and one in Metallurgy, which have been founded by the late Mr. T. Aubrey Bowen, of Melbourne. They are intended to encourage and afford facilities for the higher study of these subjects in Mason College, where they are tenable for one year, with the possibility of renewal at the discretion of the Council of the College. The annual value of each is £100. Although, naturally, good work done at Mason College will be regarded as a specially favourable qualification, the Council have generously thrown all the Scholarships open to general competition. The first award will be made in September next, and all particulars may be learned on application to the Secretary of the College.

The gold medal of the Linnean Society has this year been awarded to Prof. Ferdinand Cohn, of Breslau, whose name is well known in connection with the *Botanic Journal*, which he has conducted, largely adorned with his own contributions, from 1870 to the present time. The work of Dr. Cohn extends over half a century. He was one of the earliest to investigate the life-history of the lower Algæ, and to demonstrate that they are not asexual. His important paper on *Protococcus pluvialis*, published so long ago as 1850, was translated by Busk for the Ray Society. Subsequent papers by him, on the mode of reproduction of *Sphæroplea annulina*, and on the development of *Volvox*, mark a distinct advancement in botanical science. The medal referred to was awarded to him at the anniversary meeting of the 24th inst., and has been forwarded to Breslau, for his acceptance, through the German Embassy.

At the anniversary meeting of the Royal Geographical Society, held on Monday, the Founder's Medal was presented to Dr. John Murray for his services to physical geography, and especially to oceanography during the last twenty-three years, also for his maps of the floor of the ocean, his calculations regarding the volume of continents and oceans, his study of the origin and formation of coral deposits, and for the stimulus he has given to researches in physical geography. The other awards were the Patrons' Medal, to the Hon. George N. Curzon, M.P., (1) for his work on the history, geography, archæology, and politics of Persia; (2) for his journeys in